

## **Elevated Temperature and Ultraviolet Light Affect Condition of Reef-Building Corals**

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Reef-building corals are declining throughout the world, even at locations where human impacts are minimal. Declines have been linked to global changes in land use and climate. The U.S. Environmental Protection Agency's (U.S. EPA) Office of Research and Development is investigating the responses of corals to climate change factors, specifically elevated temperature and ultraviolet light (UV), with the objective of improving assessment capabilities and management options. Field studies are employed to estimate temperature and UV exposures and to characterize physical and biological condition of corals across Atlantic and Caribbean reefs. Laboratory studies use UV and temperature exposure levels derived from field measurements to establish dose-response relationships in corals. Data and information contribute to management strategies that focus on multiple stressors and account for the lack of local control over climate change stressors. The National Exposure Research Laboratory has been examining changes in light and temperature as a function of season, time of day, depth, and water quality in the Florida Keys. Instruments deployed from ships and moored at towers have provided the first conclusive evidence that UV penetration through water is controlled by dissolved and particulate organic carbon derived naturally from seagrasses and mangroves. This research, performed in collaboration with NOAA, Mote Marine Laboratory, and the University of Miami, has demonstrated seasonal and climate-dependent variability in water clarity and UV attenuation. The National Health and Environmental Effects Research Laboratory, in collaboration with Florida Keys National Marine Sanctuary (NOAA) and Dry Tortugas National Park (NPS), has developed tools to characterize coral condition and to track bleaching and disease that may be associated with climate change. Laboratory research has shown that elevated UV exposure exacerbates the adverse effects of higher temperature on both intact corals and symbiotic algae. Collaboration with the University of Georgia has permitted ongoing comparisons among symbiotic algae from different taxonomic groups (clades); it is hypothesized that certain clades are more tolerant to elevated temperature and UV. The National Center for Environmental Assessment is collaborating with the inter-Agency Coral Reef Task Force to develop management strategies that enhance reef resiliency to temperature and UV damage. Data on coral exposure and condition, combined with dose-response data for corals and symbiotic algae, are pivotal to strategy development. This integrated research effort generates exchange of data for environmentally relevant laboratory studies and directed field comparisons and provides coral condition and exposure scenarios relevant to resource management in the context of global change.